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USDA Programs Related to Integrated Pest Management

prepared by the Agricultural Research Service

Pursuit of IPM contributes to Departmental initiatives for water quality, food safety, global change, and sustainable agriculture as well as to other diverse programs within USDA, partner institutions associated with USDA, and other Federal agencies. IPM affects many parts of agricultural research, implementation, education, and incentive systems.

Thirteen USDA agencies are involved with various aspects of IPM.

Characteristics of IPM

Key features of IPM systems include:

Natural control: The cornerstone of IPM is maintenance and enhancement of natural controls. Myriad living things occupy the Earth. Most are not thought of as pests because they don't cause damage or are held below damaging population levels by other parts of the natural system. A healthy, diverse ecosystem tends to suppress pest problems below levels of economic consequence.

Pest monitoring and damage thresholds: Critical to effective IPM is the ability to recognize when pest numbers reach a level that can cause economic damage. Ultimately, IPM draws on information from the entire ecological system and integrates that knowledge to determine appropriate actions.

Control tactics: When natural conditions fail to keep the target pest below the economic threshold, tactics are needed that will bring the pest under control. But those tactics must not destroy the natural controls of the target pest or disturb other parts of the biological system. Control tactics fall into several categories: biological, chemical, genetic, and cultural controls and host resistance. The most critical feature of any control tactic is specificity to the target pest.

The following sections describe the various research, education, technology transfer, and action programs that USDA is undertaking to implement IPM.

Research

Research contributes to the understanding of principles and application of IPM. To develop an IPM system, research must establish procedures for controlling each pest individually and for pest complexes collectively. Often, procedures must be adapted to specific geographic regions or production systems.

Preservation and enhancement of natural pest control depends on knowledge of the ecology and biology of the production system, including the areas next to the planted acreage. Thorough knowledge of specific pest behavior and associated natural enemies has led to development of effective IPM methods to control those pests.

Agricultural researchers regularly add new principles and develop methods to count the pests and biological control agents present, predict population trends, and determine the number that will cause or prevent economic damage to the crop. For example, a cotton pest model is being field-tested to predict populations and understand interactions of the crop and the boll weevils and bollworms.

Research on natural attractants and their uses helps lead to better baits for traps that greatly improve sampling methods for pests. More complete economic research is essential to defining damage thresholds for pest systems.

Reliably predicting onset of some insect pests that travel long distances through the air can only be done through knowledge of meteorological and biological systems. Studies of such systems are especially important for development of areawide IPM.

Methods to manage pests include host resistance and biological, cultural, and chemical controls.

Host resistance to pests is present in many wild and domestic plants and animals and offers a natural and exploitable tactic for IPM. In some cases, resistant genes are being bred into commercial cultivars; in other cases, genetic engineering is

being used to pinpoint genes for resistance and to transfer those genes into cultivars in combinations to make host resistance more useful to the agricultural producer.

Biological control uses organisms capable of directly influencing the pest population. Tactics now being developed include: Maintaining the balance between a pest and its natural enemies; one-time importation of natural enemies that, once established, become a natural control; augmentation of natural enemies by periodic introductions; and application of microorganisms that specifically attack a pest. Researchers are developing methods to mass-produce biological control agents so they can be widely spread or marketed by the private sector.

Cultural control involves managing pest populations through various plant and animal production techniques. Scientists are developing specialized pest management methods based on crop rotation, alterations in planting times, manure management, use of early-maturing cultivars or trap crops, and altering tillage practices. Specific cultural practices can modify an environment in ways that lead to pest suppression.

Chemical controls are being worked on by researchers to make them more specific to the target and less toxic to nontarget organisms and are therefore less likely to be environmentally disruptive. Among the most selective of those presently under development are the sex pheromones, chemical signals emitted by one sex to attract a mate. When synthetic pheromones are placed in the pest's habitat, individuals of the attracted sex become confused, cannot find a mate, and don't produce offspring.

Some chemicals are extremely attractive or tasty to particular pests. Researchers are studying systems that use attractants combined with pesticides to yield an attracticide. Experiments with such systems show that pesticides applied as attracticides are effective at much smaller amounts per area treated compared with conventional methods.

Research is also under way to improve application technology to ensure delivery of the least amount of ingredient on the target with a minimum of nontarget effects.

One undesirable result of some pest management tactics is that many pests become resistant to the various control techniques. Numerous examples exist illustrating growing pest resistance to chemical controls, to host adaptations, and even to a cultural practice. Research to better understand how hosts and pests adapt will permit design of future pest management tactics in ways that discourage development of resistance.

To test all pest control methods involved in an IPM program requires integrative or systems-level research simulating the actual production situation. Systems-level research seeks to meet the demands imposed by the dynamics of multiple pests and their management in a total cropping system while at the same time taking into account the economic and environmental consequences of those dynamics.

USDA research on IPM is conducted in its broadest aspects by the Agricultural Research Service (ARS), the Cooperative State Research Service, and the State agricultural experiment stations (SAES). Other USDA agencies have more specific roles. The Animal and Plant Health Inspection Service (APHIS) works closely with ARS to identify research areas needed to form components of an IPM program. Forest Service and SAES scientists conduct research of similar breadth to provide the technology for implementing IPM strategies in forest ecosystems. Economic Research Service (ERS) and SAES economists conduct analyses and develop principles for economic thresholds; they also provide supervision and coordination for economic evaluations of large-area IPM programs central to demonstrating the efficacy of pest control alternatives. Through the USDA Pesticide Data Program and the Water Quality Initiative, ERS collaborates with the National Agricultural Statistics Service to collect data on the cost and return of specific IPM practices.

For additional information about specific agencies' research programs, contact:

Agricultural Research Service
National Program Staff
(James Coppedge)
Beltsville, MD 20705
301-504-5541

Animal and Plant Health Inspection Service
Science Advisor to the Administrator
(Sally McCammon)
Washington, DC 20250
202-720-3861

Cooperative State Research Service
Plant and Animal Sciences
(Robert C. Riley or Clifford J. Gabriel)
Washington, DC 20250
202-401-4781

Economic Research Service
Resources and Technology Division
(Ann Vandeman)
Washington, DC 20250
202-219-0405

Forest Service
Director, Forest Insect and Disease Research
(James L. Stewart)
202-205-1532
Washington, DC 20250

National Agricultural Statistics Service
(Sam Rives)
Washington, DC 20250
202-720-7092

Education and Technology Transfer

Extension Service funding of Cooperative Extension System (CES) programs on IPM is used to establish strong base programs at land-grant universities in each State and territory. Within the cooperative USDA/State system, CES has the greatest role in transferring pest management technologies. Farmers' greatest benefits continue to be achieved in crops with historically high rates of insecticide and fungicide use. The direct benefits of these programs are: (1) increased farm profits due to reduced pesticide expenses, (2) reduced environmental risk from pesticides, (3) maintenance, and, in some cases, enhancement of crop yields, and (4) development of a strong agricultural consulting industry. CES programs specifically address water quality, endangered species, food safety, and farm worker safety.

But CES programs include more than just agricultural IPM. Pest management programs are developed for the urban and industrial sectors as well. These programs educate homeowners and urban and industrial pest control professionals about IPM strategies that can be used in landscape, garden, home, business, and industrial settings.

The Soil Conservation Service (SCS) has developed a national conservation practice standard that includes guidance for field use of IPM techniques. SCS is currently working with the Extension Service and agricultural businesses to develop and provide training opportunities for IPM. A certification process is being developed that will ensure that agribusiness employees working in IPM are technically qualified. SCS and ES are also working with the Agricultural Stabilization and Conservation Service to promote use of IPM through the Integrated Crop Management program.

One Agricultural Research Service program conducts commercial-scale tests of IPM systems and tactics that incorporate new components that have been effective in laboratory or small-plot studies. The objective of the program is to encourage technology transfer by using large-scale demonstrations to simulate actual farm conditions.

The National Agricultural Library (NAL) has been designated as the national clearinghouse for pesticide applicator training materials used in IPM certification courses. NAL is developing a computer database to catalog this comprehensive collection. This effort helps ensure proper use of pesticides so that they contribute to, and do not detract from, successful IPM. NAL provides information on IPM primarily through its Alternative Farming Systems Information Center. This center regularly produces updated bibliographies on the subject.

The Animal and Plant Health Inspection Service (APHIS) has methods-development laboratories that provide the means for large-scale production of biological control agents. APHIS also coordinates wide-area IPM programs, including technical, operational, and economic aspects, among researchers, State cooperators, and agricultural producers. Examples of these programs include eradication and containment of the golden nematode through development of resistant plant varieties, release of sterile flies to eradicate the Mediterranean fruit fly, and use of biological agents to suppress the gypsy moth.

For specific information on USDA educational programs and technology transfer concerning IPM, contact:

Agricultural Research Service
National Program Staff
(James Coppedge)
Beltsville, MD
301-504-5541

Animal and Plant Health Inspection Service
Science Advisor to the Administrator
(Sally McCammon)
Washington, DC 20250
202-720-3861

Extension Service
Integrated Pest Management Program
(Michael Fitzner)
Washington, DC 20250
202-720-6506

National Agricultural Library
Alternative Farming Systems Information Center
Beltsville, MD 20705
301-504-5724

Soil Conservation Service
(David Schertz)
Washington, DC 20250
202-720-3783

Pest Management Implementation and Incentive Programs

The Animal and Plant Health Inspection Service (APHIS) uses IPM techniques in programs to control or eradicate exotic agricultural pests. APHIS' Plant Protection and Quarantine Division controls or eradicates foreign agricultural pests that have become established in the United States. APHIS' Veterinary Services Division conducts programs designed to control or eradicate exotic and endemic animal diseases of animal and human significance. For example, APHIS is using barrier exclusion tactics to prevent the natural migration of Mediterranean fruit flies from Guatemala into Mexico and the Southern United States. IPM technologies are also part of APHIS' Grasshopper Management Program and the Boll Weevil Eradication Program.

The Forest Service (FS) uses IPM wherever possible to control major forest pests, including the gypsy moth, southern pine beetle, western spruce budworm, and Douglas-fir tussock moth. FS provides pest protection for all federally owned forest lands and cooperates with States and landowners in protecting State and privately owned forest lands.

The Agricultural Stabilization and Conservation Service (ASCS) approved use of IPM as a cost-share practice under the Agricultural Conservation Program on a limited basis starting in 1990. The practice encourages growers to implement IPM by providing cost-share assistance of up to $7 per acre for small grains and up to $14 per acre for orchards, vegetables, and specialty crops. CES, SCS, or private crop management specialists also provide growers technical assistance. In 1992, IPM cost-share assistance was paid to 1,400 producers in 35 States.

The Federal Crop Insurance Corporation (FCIC) promotes the economic stability of agriculture through a sound system of crop insurance. The Actuarial Division of FCIC ensures that management practices allowed under crop insurance policies are actuarially sound. Cotton is one crop

the Division has targeted as an example where an effective IPM program could not only help ensure high yields, but also provide substantial long-term dollar savings to the producer.

The Soil Conservation Service (SCS) has made IPM an integral part of its programs. SCS has developed a Soil-Pesticide Interaction Screening Procedure and has added it to Field Office Technical Guides. The procedure provides a numerical rating for the leaching and runoff potential of a pesticide used on a specific site. These ratings help allow the selection of environmentally friendly pesticides.

The Federal Grain Inspection Service (FGIS) inspects and grades grain based on standards and procedures established in cooperation with marketers. In 1990, FGIS adopted a policy promoting use of biological control measures for grain insect control. FGIS has participated in development of a policy to allow biological controls such as parasitoids and predators to be used for stored products, warehouse structures, and bulk grain.

The Agricultural Marketing Service (AMS) is currently working with nine States–California, Colorado, Florida, Michigan, New York, North Carolina, Ohio, Texas, and Washington–to collect and analyze pesticide residue data on certain fresh fruits and vegetables. As mandated in the 1990 Farm Bill, AMS plans to begin a pesticide recordkeeping program in 1993 for certified applicators of Federal restricted-use pesticides. Also, as mandated by the 1990 Farm Bill, AMS plans to operate, on a fee basis, the National Laboratory Accreditation Program. This program is designed to establish minimum standards for laboratories that request accreditation and conduct residue testing of agricultural products.

The Farmers Home Administration (FmHA) provides temporary financial assistance to farmers and other rural residents unable to obtain credit elsewhere. FmHA has the authority to provide funding for IPM practices to individual farmers and ranchers. Funds may be used to purchase materials and equipment or to contract for IPM services.

The Food Safety and Inspection Service (FSIS) incorporates IPM principles and practices into inspection of meat and poultry plants, and it encourages the industry and producers of livestock and poultry to use IPM throughout the entire production process. IPM principles have been applied in the Residue Avoidance Program (RAP) to educate producers about development of alternative means for pest management and safer practices in use of pesticides to prevent contamination. Pest management is a high priority for FSIS and is primarily focused on practices such as designing, constructing, and maintaining buildings and premises to minimize the opportunity for infestation and harborage of pests. These practices work along with restricted secondary measures including traditional pesticides and physical control measures such as traps and sticky boards. FSIS may also authorize producers to use other pest management systems if safe use can be demonstrated.

For information about a specific agency's action programs, contact:

Agricultural Marketing Service
Science Division
(Craig Reed)
Washington, DC 20250
202-720-5231

Agricultural Stabilization and Conservation Service
Conservation and Environmental Protection Division
(Tim Denley)
Washington, DC 20250
202-720-3264

Animal and Plant Health Inspection Service
Science Advisor to the Administrator
(Sally McCammon)
Washington, DC 20250
202-720-8014

Federal Crop Insurance Corporation
(Kirk Bryant)
Washington, DC 20250
202-475-3963

Farmers Home Administration
Associate Administrator
(Fred Medero)
Washington, DC 20250
202-720-5614

Federal Grain Inspection Service
Standards and Procedures Branch
(John Giler)
Washington, DC 20250
202-720-0252

Food Safety and Inspection Service
Equipment Standards and Review Branch
(Linda Madson)
Washington, DC 20250
202-720-7386

Forest Service
Forest Pest Management
(James C. Space)
Washington, DC 20250
202-205-1600
or
Forest Insect and Disease Research
(James L. Stewart)
Washington, DC 20250
202-205-1532

Soil Conservation Service
(David Schertz)
Washington, DC 20250
202-720-3783